

1- Write down expression for the E- and H- plane patterns for a uniformly illuminated rectangular aperture.

b- For a uniformly illuminated $5\lambda \times 3\lambda$ rectangular aperture with y- polarized electric field:

- i- Find and sketch the field pattern in both E and H planes.
- ii- Estimate the 3-dB beam width and the gain.

2- For a uniformly illuminated circular aperture ($a=3\lambda$) with y- polarized electric field:

- i- Find and sketch the field pattern in both E and H planes.
- ii- Estimate the 3-dB beam width and the gain.

3- For a square aperture ($5\lambda \times 5\lambda$) with uniform amplitude feeding and linear phase shift $e^{j\pi x/2}$ and a square blockage ($2\lambda \times 2\lambda$) in the center and the aperture electric field is polarized in y- direction. Derive expressions for the far field patterns in the x-z and y-z planes indicating the E and H planes.

4- For a uniform illumination rectangular aperture, if the E field is y polarized, the 3-dB beam width in the H plane is assumed to be 10.2° and directivity is 22.753dB. Find the aperture dimensions and sketch the E and H plane patterns.

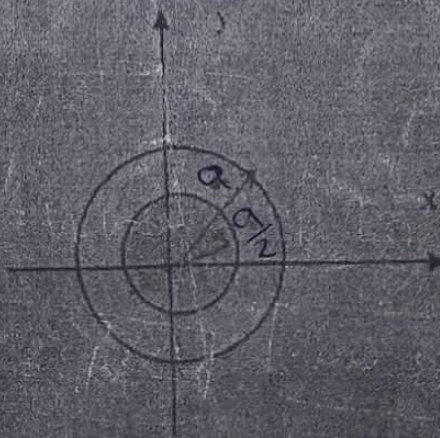
5- Drive expressions for the E and H plane patterns of a rectangular aperture if:

$$E(x', y') = E_0 \text{tri} \frac{y'}{b/2}$$

\hat{x}

electric field in x direction

6- Drive expressions for the E and H plane patterns of the uniformly illuminated circular aperture with a center blockage as shown in figure.



Handwritten notes and calculations at the bottom right corner, including the date 21/3/20 and some mathematical expressions.